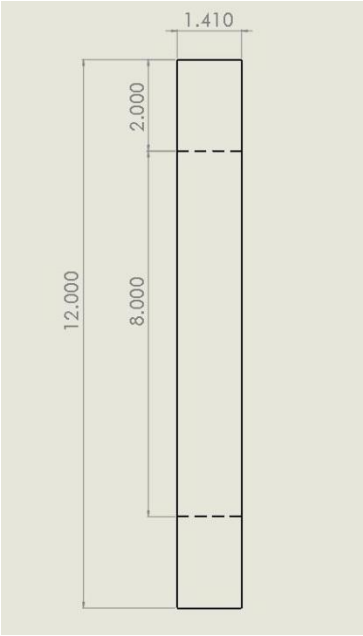
A&P guidelines for testing QISO braided fabric

Below are A&P Technology's recommendations for standard mechanical testing of braided composites, specifically the QISO-Heavy architecture. These recommendations are based on technical studies as well as A&P's extensive experience testing braided composites. All test coupons in this document are oriented with the axial fibers (0° fibers) spanning vertically.

Tensile Testing (ASTM D3039 and modified ASTM D3039)

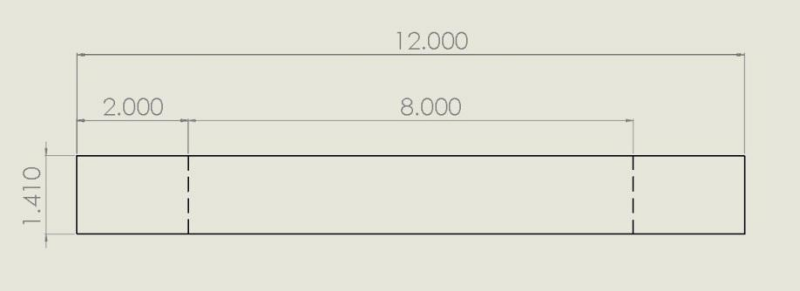
Longitudinal (0°) Tensile Test- ASTM D3039 is recommended to obtain longitudinal tensile strength and tensile modulus. All test parameters are standard to the ASTM, except the width of the specimen which is adjusted to 1.410". This allows 4 "unit cells" of the braid to fit across the width which should lead to more consistent testing. Below is the geometry of the test coupon. It is recommended that the specimens are tabbed prior to testing to protect them from being damaged by the test grips. The edges of the tabs and grips are represented by dashed lines in the figure below.



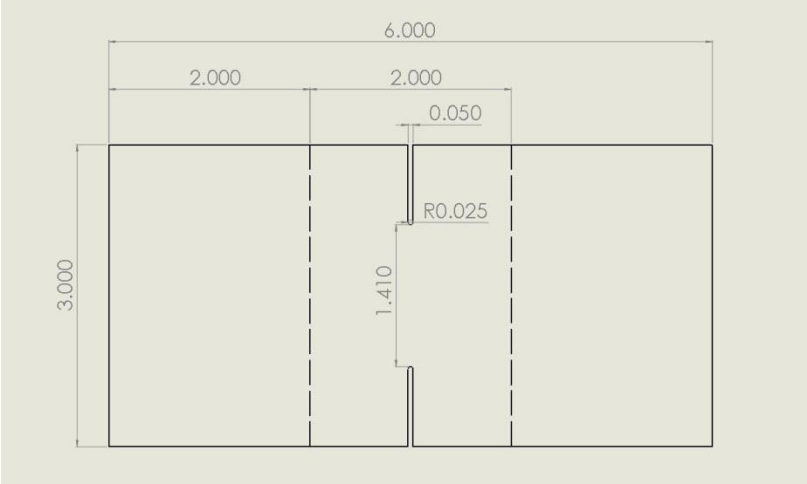
ASTM D3039 test coupon with width modified to 1.410".

Transverse (90°) Tensile Test- Transverse tensile modulus is obtained by using the standard ASTM D3039 with the coupon width adjusted to 1.410". A modified notched coupon is used to acquire the transverse tensile strength due to the unique architecture of the braid. With the standard straight sided coupon, none of the carbon fiber reinforcement spans from grip to grip. Instead, the carbon fibers loaded by the grips terminate at the edges of the coupon which induces negative edge effects. The notched coupon was developed to eliminate these factors which cause artificially low strength data in the transverse direction. Due to the complex strain field generated

when testing this coupon, transverse modulus should not be calculated using this coupon. Tabbing the notched coupon is not necessary, but tabbing the straight sided coupon used for modulus is recommended. The geometry for both coupons is defined in the figures below.



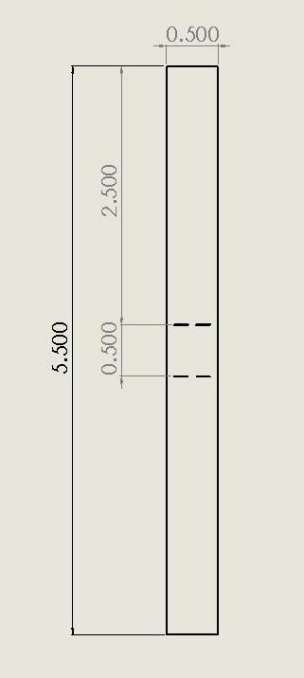
ASTM D3039 test coupon for transverse tensile modulus.



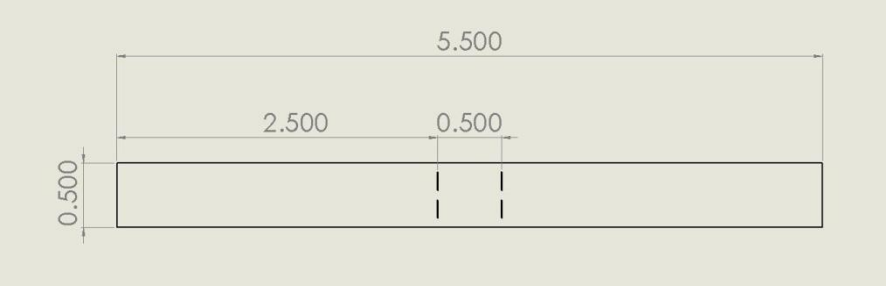
Notched tensile coupon used for transverse tensile strength.

Compression Testing (ASTM D6641)

Longitudinal (0°) and Transverse (90°) Compression Test- The standard ASTM D6641 is used to test compressive strength and modulus in the 0° and 90° directions. It is recommended to tab these coupons, leaving a 0.5" gauge width exposed. The geometry for the compression coupons is defined in the figures below.



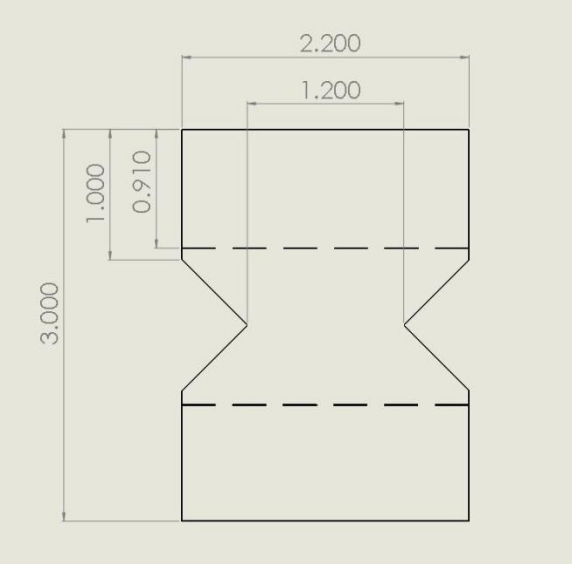
ASTM D6641 test coupon for longitudinal compression.



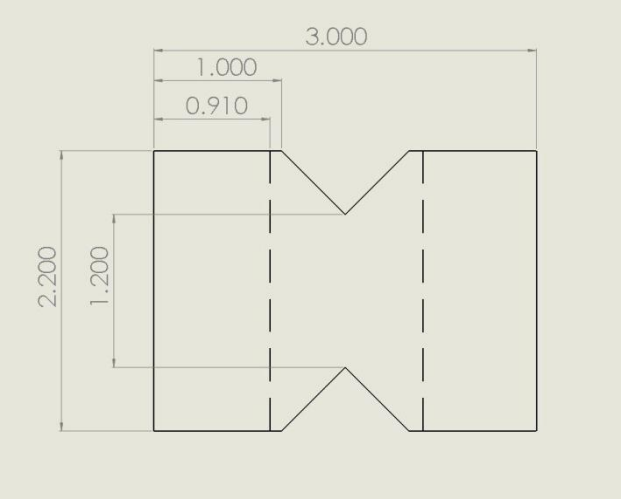
ASTM D6641 test coupon for transverse compression.

In-plane Shear Testing (ASTM D7078)

Longitudinal (0°) and Transverse (90°) In-plane Shear- The standard ASTM D7078 is used to gather in-plane shear strength and modulus. It is not necessary to tab these test coupons as long no excessive crushing occurs from the test grips. The geometry for the in-plane shear coupons is defined in the figures below.



ASTM D7078 test coupon for longitudinal in-plane shear.



ASTM D7078 test coupon for transverse in-plane shear.